Hydrocyclone Development Consortium

Michigan State University *College of Engineering*

Summary

The Hydrocyclone Development Consortium (HDC) was formed in the Fall of 1990 to further develop a new class of hydrocyclones designed to remove a *light* dispersed phase (*i.e.* oil and grease) from a *heavy* continuous phase, such as produced water on offshore platforms. During an early proof-of-concept stage funded by the MSU foundation and the U.S. Department of Energy, a prototype of the new separator (see U.S. Patent 4,855,066) was tested at relatively low capacities and high overflow rates. Additional exploratory studies were funded by Krebs Engineers of Menlo Park, California.

In order to test the MSU hydrocyclone under more realistic conditions, the HDC was formed as a pre-competitive research consortium. The HDC provided the funding to upgrade the testing facilities at MSU and to support the further evaluation and development of the MSU deoiling hydrocyclone. The project consisted of four complementary technical phases:

- design, construction, and testing of a multiphase flow loop;
- installation and evaluation of an on-line particle size distribution monitor based on laser light scattering;
- evaluation of a series of hydrocyclone designs using a model light dispersion of glass microbubbles suspended in water; and,
- evaluation of selected designs for liquid/liquid separation using a model dispersion of kerosene in water at room temperature.

The technical results of the 6-year project are contained in seven research reports (HDC-R1 through HDC-R7) and six supplemental reports (HDC-S1 through HDC-S6). These reports are listed below and Professor Petty may be contacted regarding their availability.

Participants

- Amoco
- Arco
- Chevron
- Exxon
- Krebs Engineers
- Marathon
- Monosep Corporation
- Texaco
- U.S. Navy
- U.S. Deparment of Energy

Project Results

- *Separation Performance of Deoiling Hydrocyclones* (**HDC-R1**; 94 pages)
- *Prediction of Angular Momentum Distribution in Deoiling Hydrocyclones Using a Constant Eddy Viscosity Model* (**HDC-R2**; 23 pages)
- *An Experimental Study of Internal Flow Structures of a Deoiling Hydrocyclone* (**HDC-R3**; 54 pages)
- *Characterization of Particle Size Distributions for Kerosene-Water Dispersions in Complex Flows* (**HDC-R4**; 128 pages)
- *Flow Visualization in a Confined Vortex Flow* (**HDC-R5**; 102 pages)
- *Separation of a Light Dispersion in a Cylindrical Vortex Chamber* (**HDC-R6**; 79 pages)
- *Investigations on the Maximum Stable Drop Size in Turbulent Pipe Flows* (**HDC-R7**; 136 pages)

- *MSU Multiphase Flow Facility* (**HDC-S1**; 10 pages)
- *Hydrocyclone Designs Tested* (**HDC-S2**; 32 pages, confidential)

- *Bibliography* (**HDC-S3**; 48 pages, 682 citations)
- *MSU Sampling Flow Loop* (**HDC-S4**; 28 pages, confidential)
- *Hydrocyclone Data Analysis and Software Development* (**HDC-S5**; 71 pages)
- *Online PSD and Concentration Monitor* (**HDC-S6**; 35 pages)

- Process Engineering Concept

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